



Digital Energy  
Multilin

# MultiLink MC-E10 & MC-E100 Converters Instruction Manual

Firmware Revision 1.x

Manual P/N: 1601-9088-A1

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## GE Multilin

215 Anderson Avenue, Markham, Ontario  
Canada L6E 1B3

Tel: (905) 294-6222 Fax: (905) 201-2098

Internet: <http://www.GEmultilin.com>



GE Multilin's Quality  
Management System is  
registered to ISO9001:2000

QMI # 005094  
UL # A3775

*These instructions do not purport to cover all details or variations in equipment nor provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the General Electric Company.*

*To the extent required the products described herein meet applicable ANSI, IEEE, and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.*

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GE Multilin Multilink MC-E10 & MC-E100 instruction manual for revision 1.x.

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Part number: 1601-9088-A1 (April 2009)

## **Federal Communications Commission**

### **Radio Frequency Interference Statement**

This equipment generates, uses and can radiate frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

### **Electrical Safety requirements:**

1. This product is to be installed Only in Restricted Access Areas (Dedicated Equipment Rooms, Electrical Closets, or the like).
2. 48VDC products shall be installed with a readily accessible disconnect device in the building installation supply circuit to the product.
3. This product shall be provided with a maximum 10A DC Listed fuse or circuit breaker in the supply circuit when connected to a 48V centralized DC source.
4. The external power supply for DC units shall be a Listed, Direct Plug In power unit, marked Class 2, or Listed ITE Power Supply, marked LP, which has suitably rated output voltage (i.e. 24VDC or 48VDC) and suitable rated output current.

Product does not contain user replaceable fuses. Any internal fuses can ONLY be replaced by GE Multilin personnel through the RMA process.

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# Multilink MC-E10 & MC-E100 Converters

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## 1. Specifications

### PORTS PERFORMANCE

When a port is operating at 100Mbps:

Data Rate: ..... 100Mbps

When a port is operating at 10 Mbps:

Data Rate: ..... 10 Mbps

### NETWORK STANDARDS

100Mb: ..... Ethernet IEEE 802.3u, 100BASE-TX,  
100BASE-FX

10 Mb: ..... Ethernet IEEE 802.3, 10BASE-T

Auto-sensing for speed: ..... IEEE 802.3u

### PACKET-PROCESSING BETWEEN DOMAINS

Filter and Forward Rate from 100Mbps ports: ..... 148,800 pps max

Filtering and Forwarding Rate from 10 Mbps ports: ..... 14,880 pps max.

Processing type: ..... Store and Forward, non-blocking

Auto-learning: ..... 2K address table

Address buffer age-out time: ..... 300 sec.

Packet buffers memory: ..... 128KB, dynamically shared on all  
domains

Latency (not including packet time): ..... 100 to 10 Mbps: 5 $\mu$ s  
10 to 100Mbps: 15 $\mu$ s

### PATH DELAY VALUE

50 BT on all ports

### MAXIMUM ETHERNET SEGMENT (OR DOMAIN) LENGTHS

10BASE-T (Unshielded twisted pair): ..... 100 m (328 ft)

10BASE-FL, Fiber optic: ..... 2.0 km (6,562 ft)

10BASE-FL, Single-mode Fiber optic: ..... 10.0 km (32,810ft)

100BASE-TX (CAT 5 UTP): ..... 100 m (328 ft)

100BASE-FX, half-duplex (multi-mode): ..... 412 m (1350 ft)

100BASE-FX, full-duplex (multi-mode): ..... 2.0 km (6,562 ft)

100BASE-FX, half-duplex (single-mode): ..... 412 m (1350 ft)  
100BASE-FX, full-duplex (single-mode): ..... 20.0 km (65,620 ft)  
100BASE-FX, full-duplex (single-mode, long reach): ..... 40.0 km (131,240 ft)

**OPERATING ENVIRONMENT- AMBIENT TEMPERATURE**

Multilink MC-E10, Multilink MC-E100: ..... 32 ° F to 104 ° F (0 ° C to 40 ° C)  
Long term per independent agency tests (UL): ..... -40 ° F to 149 ° F (-40 ° C to 85 ° C)  
Short term per IEC Type tests: ..... -40 ° F to 167 ° F (-40 ° C to 75 ° C)  
Storage Temperature, All models - Cold Start: ..... to -40 ° C  
Ambient Relative Humidity: ..... 5% to 95% (non-condensing)  
Altitude (All models): ..... -200 to 50,000ft. (-60 – 15,000 m)  
Conformal Coating (optional) for Humidity protection



These models are designed for NEBS compliance, including, vibration, shock and altitude.

**PACKAGING**

Enclosure: ..... Rugged sheet metal (Steel)  
Dimensions, Switch unit: ..... Height x Width x Depth  
3.5 in H x 3.0 in W x 1.0 in D  
(8.9 cm x 7.6 cm x 2.5 cm)  
Weight - all models: ..... 8 oz. (227g)  
Power supply weight: ..... 7.9 oz (225g)

**COOLING METHOD**

Convection, plus the case is used as a heat sink.

**POWER SUPPLY**

**AC Power Supply** (using an external power adapter):

All models have a (8 to 15) V DC output with 6ft long cord and a 2.5mm center +ve jack. The power supplies are temperature rated to match the Converter Switch ratings.

Temperature un-controlled Ratings (-40 to 75°C): ..... Outdoor temperature rated.

**Input:** IEC 320 connector on the 100 to 240 V AC 47 to 63 Hz external power adapter. Requires a user supplied power cord.

**Output:** 12 V DC, 2 A

**Direct DC Power Supply:**

Built-in terminal block for +, -, ground along with 12 V DC jack

12 V DC internal (range of 8.0 to 15 V DC).

24 V DC internal (range of 18 to 36 V DC).

-48 V DC internal (range of 36 to 60 V DC), -, ground

**POWER CONSUMPTION**

3 watts typical and 4 watts max. for all models



NOTE

8-15V DC can be used for dual source DC input



NOTE

Internal DC power floats, user may ground "+" or "-" if desired.

**PORT CONNECTORS**

RJ-45 Port: ..... Auto-cross (MDIX), 100BASE-TX and 10BASE-T:shielded 8-pin female.  
Three RJ-45 port provided in front and one on the rear. Supports shielded (STP) and unshielded (UTP) Cat 3,4,5 cable. For POE pass-through option on H and P models, request quote.

**SWITCHES**

Fiber Port # 1 is controlled by an "F – H" switch, provided underneath port

"F" enables Full duplex to the fiber port #1

"H" enables Half duplex to the fiber port # 1

**LED INDICATORS (DUAL- FRONT AND END)**

POWER: ..... Steady On when power applied  
10/100: ..... ON = 100Mbps; OFF = 10 Mbps  
LK/ACT: ..... Steady On for LINK (LK) with no traffic, blinking indicates port is transmitting / receiving (ACT).  
F/H: ..... ON = full-duplex, OFF = half-duplex

**MOUNTING OPTIONS FOR MULTILINK MC-E10 & MC-E100 FAMILY OF SWITCHES**

Metal Mounting clips for panel mounting: ..... Included

DIN-Rail mounting option: ..... Model # DIN-RAIL MC2 (see Section 3.4)

Rack-mount option: ..... MC14-TRAY, see URL

**MEAN TIME BETWEEN FAILURE (MTBF)**

15+ years, Telcordia (Bellcore) Method

**AGENCY APPROVALS AND STANDARD COMPLIANCE**

UL Listed (UL 60950), cUL, CB, CE Low Volt. Dir. & Electro-Mag. Comp.

Emissions: ..... Meets FCC Part 15 Class A and ETSI IEEE P1613 Environmental Std for Electric Power Substations.  
UL 2043 for above-the -ceiling (plenum) installation.  
NEMA TS-2 (1998) for traffic control equipment.

**WARRANTY**

Three years, return to factory ..... Made in USA

## 2. Ordering Codes

ML-MC-E10 - * - * - * -				
Base	ML MC-E10			MultiLink MC-E10 Converter Switch
Power supply	230			MC-E10 Converter 230 V AC
	115			MC-E10 Converter 115 V AC
	48			MC-E10 Converter 48 V DC
	24			MC-E10 Converter 24 V DC
	12			MC-E10 Converter 12 V DC
Modules	F1			10 Mbit ST mm Fiber
	F2			10 Mbit ST sm Fiber 10 km
			X	None
			H	Harsh Chemical Environment Conformal Coating
			Z	RoHS Compliant
			Y	RoHS Compliant with Harsh Chemical Environment Coating

ML-MC-E100 - * - * - * -				
Base	ML MC-E100			MultiLink MC-E100 Converter Switch
Power supply	230			MC-E100 Converter 230 V AC
	115			MC-E100 Converter 115 V AC
	48			MC-E100 Converter 48 V DC
	24			MC-E100 Converter 24 V DC
	12			MC-E100 Converter 12 V DC
Modules	F1			100 Mbit SC mm Fiber
	F2			100 Mbit ST mm Fiber
	F3			100 Mbit MTRJ Fiber
	F4			100 Mbit LC mm Fiber
	F5			100 Mbit SC sm Fiber 20 km
	F6			100 Mbit SC sm Fiber 40 km
	F7			100 Mbit ST sm Fiber 20 km
	F8			100 Mbit LC sm Fiber 15 km
	F9			100 Mbit LC sm Fiber 400 km
			X	None
			H	Harsh Chemical Environment Conformal Coating
			Z	RoHS Compliant
			Y	RoHS Compliant with Harsh Chemical Environment Coating



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## 3. Introduction

This section describes Multilink MC-E10 & Multilink MC-E100 models, including appearance, features and typical applications.

### 3.1 Inspecting the Package and the Product

Examine the shipping container for obvious damage prior to installing this product; notify the carrier immediately of any damage which you believe occurred during shipment or delivery. Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

This package should contain:

- 1 Multilink MC-E10 or Multilink MC-E100 Converter Unit,
- 1 External Power Supply, (for Multilink MC-E10 or Multilink MC-E100) d, i model only)
- 1 set Metal panel mounting clips and screws, 2 each
- 1 User Guide, i.e., this manual

Remove the Multilink MC-E10 or Multilink MC-E100 Converter from the shipping container. Be sure to keep the shipping container should you need to ship the unit at a later date. In the event there are items missing or damaged contact your supplier. If you need to return the unit use the original shipping container. Refer to *Section 6.0: Troubleshooting*, for specific return procedures.

### 3.2 Product Description

The multi-tasking, multi-environmental, multi-media (Copper and fiber) equipped with multi-power (AC or DC) supply, 3-ports (two 10/100 RJ45+ one 10 or 100Mb fiber) Multilink MC-E10 & Multilink MC-E100 Converters offer a flexible, cost-effective connectivity solution for on-going demand of Ethernet Network. Available in two different flavors of fiber speed, 10Mb ST fiber as Multilink MC-E100 model and 100Mb (SC, MTRJ, LC) fiber as Multilink MC-E10, the Multilink MC-E10 & Multilink MC-E100 Series are useful Ethernet devices for the edge-of-network application. The plug and play, energy-efficient, and flavor-rich fiber features make this sleek multi-purpose Converter convenient and cost-effective for the user. The selection of various temperature ranges enable easy deployment in various environments and qualify the Converter as a flexible solution, which provides multiple solutions using very small space. Providing the combination of media converter with Switch, the Multilink MC-E10 & Multilink MC-E100 Series is an ideal choice for edge-of-the-network applications.

The Multilink MC-E10 & Multilink MC-E100 models units are for office and wiring closet environments and use an external AC power supply. A metal case with convection cooling is featured. Ambient operating temperature is 0° to 40°C. Storage temperature rating is -40° to 85°C. The units can be mounted securely on a closet wall or metal cabinet by using the metal panel mounting clips included.

The versatility options of the Multilink MC-E100 model allow users a wide choice in how to connect to their 10 or 100Mb domain easily, without adding any additional media converters.

The Multilink MC-E10 models provide several options of 100Mb fiber flavor (SC, MTRJ and LC) connectors.

The Multilink MC-E10 is a premium rated unit suitable for temperature un-controlled outdoor applications, and is specially designed with premium-grade extended temperature components. Mounting options include panel-mounting, DIN-rail, or rack-mount tray. Choices of models for external AC or internal DC power are available. Ambient operating temperature is between -40°C to +75°C. Storage temperature rating is between -40°C to +85°C depending on the power source used.

### 3.3 Multilink MC-E10 & MC-E100 Series chassis (2+1) with two 10/100 (RJ-45) ports + one (10 or 100) Fiber port

The Multilink MC-E10 & Multilink MC-E100 Series chassis house one main PC board. The power supply unit may be external AC as well as Internal DC. The front side of the chassis has two twisted-pair 10/100 switched ports and one 10 or 100Mb fiber port. Both the RJ-45 ports of the Multilink MC-E10 & Multilink MC-E100 Converters support auto-cross (MDIX) operation performing the auto-cross function under auto-negotiation mode only. The 10Mb fiber (Model Multilink MC-E100) is factory configured at Half-duplex, and 100Mb fiber (Model Multilink MC-E10) at Full-Duplex.

Dual LEDs to indicate operating status of ports are mounted on the top as well as front for extra viewing advantage while rack-mounted. There is a power (PWR) indicator for the unit to validate that the unit is turned ON. For each port, there are Link and Activity (LK/ACT) LED's on the top of the unit indicating that the media cables are connected correctly and also indicating when there is traffic (flashing). These LK/ACT LED's are repeated on the front as LA1 (port 1), LA2 (port 2), and LA3 (port 3).

The single-fiber port has been offered as an ST connector (Single or Multi-mode) for (Model Multilink MC-E100) and as an SC/Small form-factor connector (MTRJ-multi mode and LC-Single mode) for 100 Mb (Model Multilink MC-E10). The "F- H" manual-Switch provided underneath the fiber port, allow the user to fix the fiber port at 10 or 100Mb Half or Full Duplex mode as per the requirement by sliding the manual switch. See Section 4.4.

The external DC power plug connector or "jack" is in the right rear of the chassis, whereas the internal DC input terminal is provided on the rear side of the unit.

### 3.4 Frame Buffering and Latency

Multilink MC-E10 & Multilink MC-E100 Series Converters are store-and-forward switches. Each frame (or packet) is loaded into the Switch's memory and inspected before forwarding can occur. This technique ensures that all forwarded frames are of a valid length and have the correct CRC, i.e., are good packets. This eliminates the propagation of bad packets, enabling all of the available bandwidth to be used for valid information.

While other switching technologies such as "cut-through" or "express" impose minimal frame latency, they will also permit bad frames to propagate out to the Ethernet segments connected. The "cut-through" technique permits collision fragment frames, which are a result of late collisions, to be forwarded to add to the network traffic. Since there is no way to filter frames with a bad CRC (the entire frame must be present in order for CRC to be calculated), the result of indiscriminate cut-through forwarding is greater traffic

congestion, especially at peak activity. Since collisions and bad packets are more likely when traffic is heavy, the result of store-and-forward operation is that more bandwidth is available for good packets when the traffic load is greatest.

To minimize the possibility of dropping frames on congested ports, each Multilink MC-E10 & MC-E100 Converter dynamically allocates buffer space from 128Kb memory pool, ensuring that heavily used ports receive very large buffer space for packet storage. (Many other switches have their packet buffer storage space divided evenly across all ports, resulting in a small, fixed number of packets to be stored per port. When the port buffer fills up, dropped packets result.) This dynamic buffer allocation provides the capability for the maximum resources of the Multilink MC-E10 & Multilink MC-E100 units to be applied to all traffic loads, even when the traffic activity is unbalanced across the ports. Since the traffic on an operating network is constantly varying in packet density per port and in aggregate density, the Multilink MC-E10 & MC-E100 Converters are constantly adapting internally to provide maximum network performance with the least dropped packets.

When the Switch detects that its free buffer queue space is low, it sends industry standard (full-duplex only) PAUSE packets out to the devices sending packets to cause "flow control". This tells the sending devices to temporarily stop sending traffic, which allows a traffic catch-up to occur without dropping packets. Then, normal packet buffering and processing resumes. This flow-control sequence occurs in a small fraction of a second and is transparent to an observer.

Another feature implemented in Multilink MC-E10 & Multilink MC-E100 Series Converters is a collision-based flow-control mechanism (when operating at half-duplex only). When the Switch detects that its free buffer queue space is low, it prevents more frames from entering by forcing a collision signal on all receiving half-duplex ports in order to stop incoming traffic.

The latency (the time the frame spends in the Converter before it is sent along or forwarded to its destination) of the Multilink MC-E10 & Multilink MC-E100 Converter varies with the port-speed types. The length of the frame is a variable here as it is with all store-and-forward switches. For 10 Mb-to-10 Mb or 10 Mb-to-100Mb or 100Mb-to-10 Mb forwarding, the latency is 15 microseconds plus the packet time at 10 Mb. For 100Mb-to-100Mb forwarding, the latency is 5 microseconds plus the packet time at 100Mb.

### 3.5 Features and Benefits

- **Full 100Mb or 10 Mb switching services for high performance Ethernet LANs**

Multilink MC-E10 & Multilink MC-E100 Converters provide Fast Ethernet switching on all ports. They perform high speed filter/forward operations on the traffic, giving each port's segment a full 100Mb (or 10 Mb) of bandwidth.

- **Reduces Network Costs and provide economical solution**

Multilink MC-E10 & Multilink MC-E100 Converters offer the ideal solution to efficiently and inexpensively connect a Twisted Pair and fiber network with 10Mb or 100Mb and help to expand the Ethernet network in a very convenient and economical way.

- **Choice of 10 or 100Mb Fiber option, more efficient than media converter**

Designed as a multi-purpose media converter, the 10 or 100Mb fiber port allows the user to convert the media from copper to fiber and the other RJ-45 ports can be used as diagnostic ports or for more connectivity.

- **Installation is "Plug and Play", operation is transparent to software**

The Multilink MC-E10 & Multilink MC-E100 Converter operates as a hardware switch, only forwarding those packets from each domain that are needed on the other domains. Internal address tables are self-learning, enabling users to change port connections or 10/100 domains without affecting operations.

- **Two sets of LEDs for viewing status from any angle.**

Each Multilink MC-E10 & Multilink MC-E100 Converter is equipped with two sets (front and top) of LEDs to provide status information when viewed at any angle or mounting arrangement, rack-mounted (MC14- Tray) or wall-mounted.

- **Rugged metal case, Industrial grade**

Multilink MC-E10 & Multilink MC-E100 Series have a robust design and are packaged in a rugged sheet metal enclosure to ensure high reliability and durability even when placed in industrial or outdoor applications.

- **Qualified to use for temperature un-controlled "outdoor" application**

The Multilink MC-E10 Converter supports an ambient temperature rating between -40C to +75C for DC models, which qualify for un-controlled "outdoor" application.

- **Efficient Compact design, for all purpose convenient mounting**

Featuring a compact steel case with an external AC and internal DC power supply, Multilink MC-E10 & Multilink MC-E100 units can be installed with minimal space in rack mount cabinets like MC14-TRAY, on table-tops or wall-mounted.

- **MDIX ports to eliminate cross-over cable while cascading**

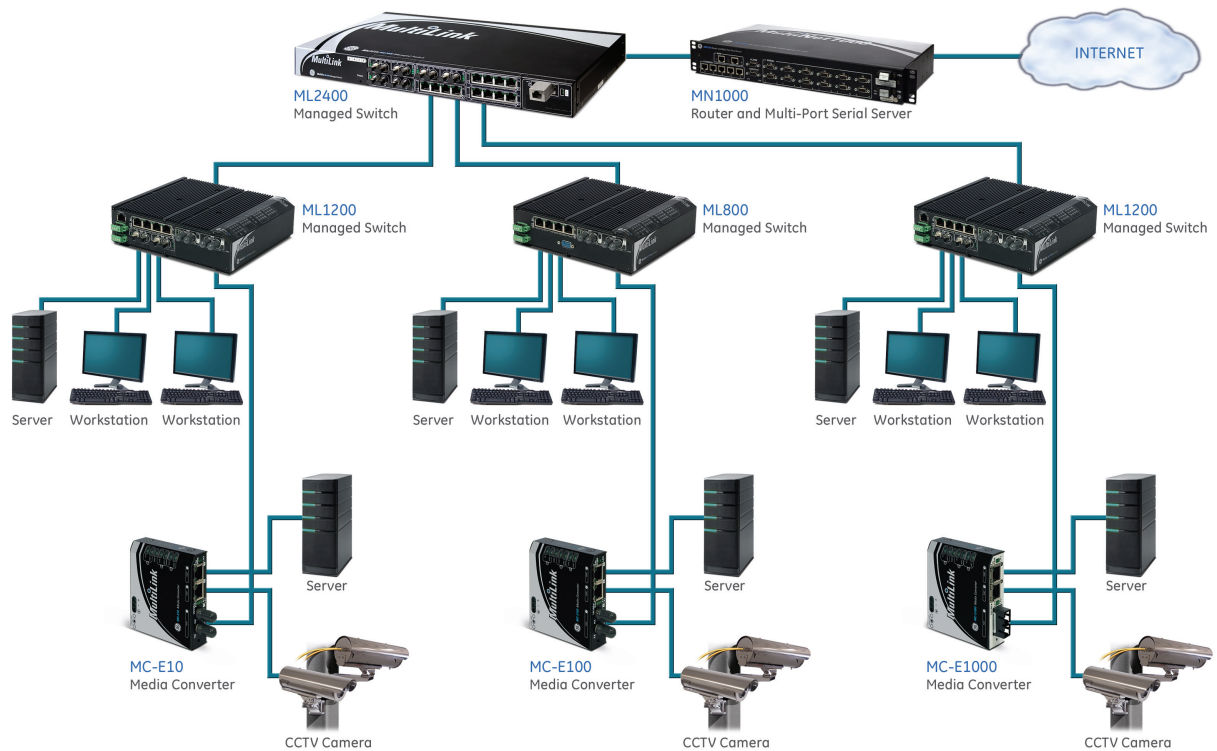
All the Multilink MC-E10 & Multilink MC-E100 Series Switches are featured with MDIX (auto-cross), which easily allow cascading with other Switch Hubs or media converters, without using the cross-over cable.

### 3.6 Applications for Multilink MC-E10 & Multilink MC-E100 Series Converters

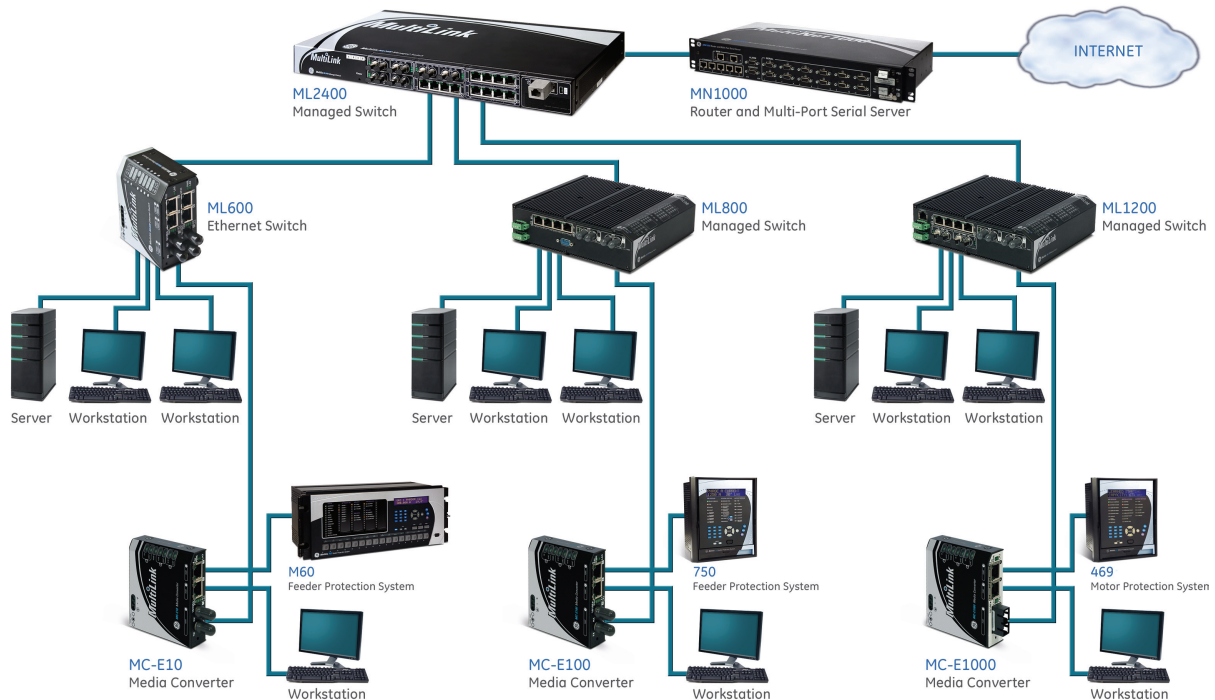
The multifunctional, multi-media and multi-environmental, Multilink MC-E10 & Multilink MC-E100 Series Converter Switches fit very well in almost any environment enabling the user to scale their LAN quickly and cost effectively. The edge-of-the-network connectivity

solution offered by GE Multilin, is focused on providing easier, more economical and extra-reliable industrial application products. The compact designed Multilink MC-E10 & Multilink MC-E100 Series act as a very useful tool in the modern life of fast expanding network requirements. The Dual-Speed and Dual-media functions support a mixed environment of 10 Mbps and 100Mbps users with copper and fiber media. The switching full / half duplex capability on fiber ports provides high bandwidth seamless performance. The up-link of choice of 10 or 100Mb on fiber Port #1 enables easy expansion, longer distance coverage and secure networking for the on-going demand of Ethernet networks.

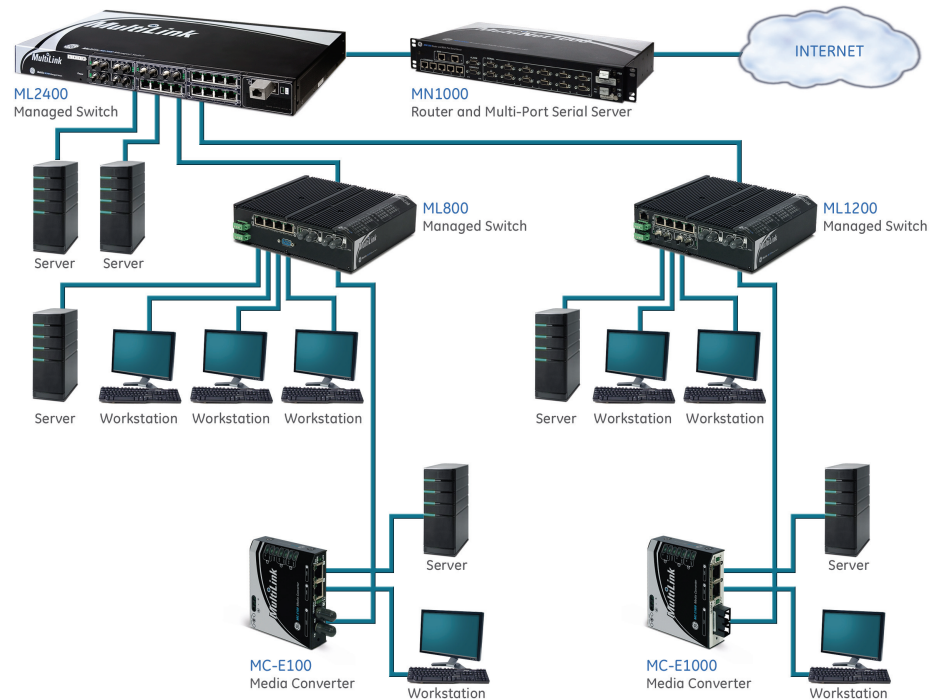
#### Example 1.



In this example, the Multilink MC-E10 & Multilink MC-E100 Series Converters are being deployed together to serve a secured corporate office, spread out in miles with multi-servers, print server, internet access and mixed-speed requirements, but distance and security is the major issue to resolve, since each of the video surveillance camera is located more than 100m at the far end to secure the office. The users operate at 100Mb as well as at 10 Mb, and utility devices (such as print servers) run at 10 Mbps. High performance users need a high bandwidth up-link for access to a central LAN and central file servers. Any attached node can change speed at any time without affecting network operation or impacting other users. The multi-functional Multilink MC-E10 & Multilink MC-E100 Series Converters provide this solution very efficiently and economically. Various features included 10 or 100Mb of fiber flavor option, MDIX, plug-n-play, Din-Rail mountings and dual LEDs, rack-mounting option through MC-Tray make this compact Converter a very effective solution for this requirement.

**Example 2.**

In this application of Industrial environments, where in a expanding of Industrial network environment, the new PLC units are deployed on all the present network and need a Ethernet port to carry the data to the main workstation for being controlled by the Industrial Engineering crews. The hardened version of Multilink MC-E10Hs are typically used where 10/100BASE-T networking equipment is being installed in highly controlled temp environment and required a effective and economical solution to satisfy this need. Built with high-grade components and efficient thermal techniques of cooling, and equipped with wide variety of options of AC and DC power, the Multilink MC-E10 & Multilink MC-E100 Series Converter Switches provide the efficient solution for this need. The Fiber port option on the converter switches is really suitable for this edge of network requirement, where covered distance is also a primary concern to deal with.

**Example 3:**

The Multilink MC-E10 fits very well in high temperature locations (control rooms) where there is a need to scale its LAN quickly and cost effectively. With its half / full duplex switching capability on fiber port # 1, the Multilink MC-E10 provides a very economical high bandwidth solution at each -cable user-access point of copper, and also easily solve the long distance requirement with the fiber port. The ruggedness of the Multilink MC-E10's steel case and the high reliability of the design compliments the temperature controlled packaging to provide an exceptional Ethernet product.

In this example, the extended temperature rated Multilink MC-E10Ps takes care of the LAN connectivity requirement in a harsh temperature environment, mounted above the ceiling in the building. In this location the Data Mining through SAN is required for the equipment used in the harsh temp and send over to the server. The ongoing demand of growing network can be easily met by this sleek designed Converter. The steel enclosure and wide selections of DC power input qualifies the Multilink MC-E10Ps to provide a dependable, reliable and economical solution for any temperature un-controlled location environments.

The above mentioned applications are just few of the examples, and are an attempt to make the user aware of the importance and multi-purpose use of this small Converter. In the on-going demand of Ethernet at the present time, the Converter provides a very economical and efficient solution to the users, and fills out all of the potential spots of Ethernet requirements, while holding minimum space.

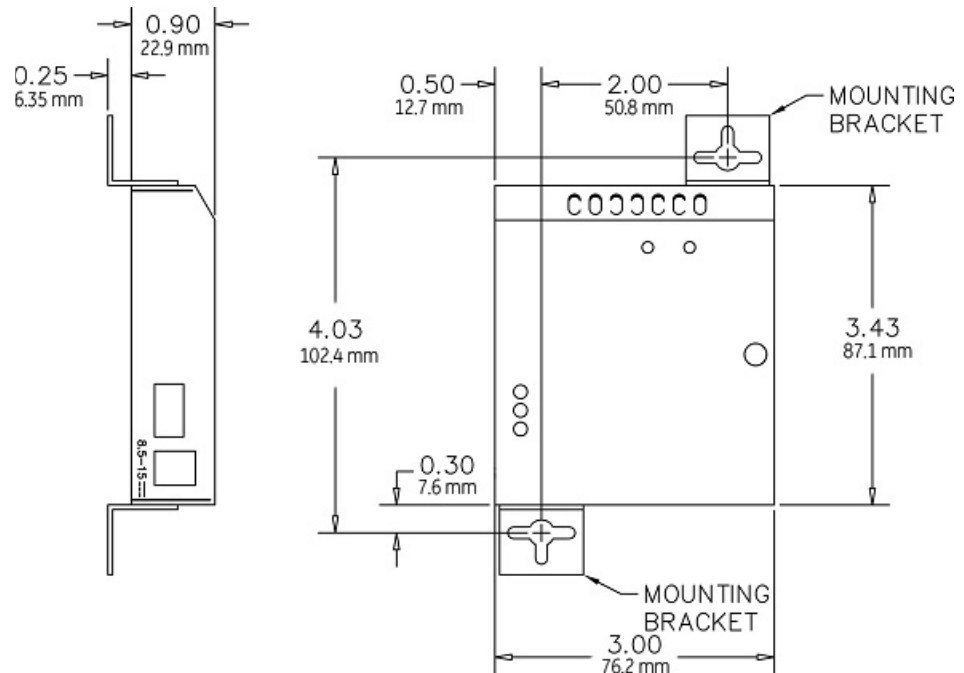
## 4. Installation

This section describes the installation of the Multilink MC-E10 & Multilink MC-E100 Converters, including location, mountings, power supply options and media connection.

### 4.1 Locating the Converter Unit

All the Multilink MC-E10 & Multilink MC-E100 Converters operate in transparent half-and full-duplex mode. The store and forward switch easily takes care of the network traffic and can be used as a useful economical tool to expand the existing network.

The compact and lightweight design of the Multilink MC-E10 & Multilink MC-E100 Series allows them to be easily installed in almost any location. A Velcro strip may be used for mounting the unit on a vertical surface such as a wall or cabinet, or for securing the unit on a table-top or shelf. Alternatively, metal mounting clips and screws are included for a rugged and secure mounting in any orientation.

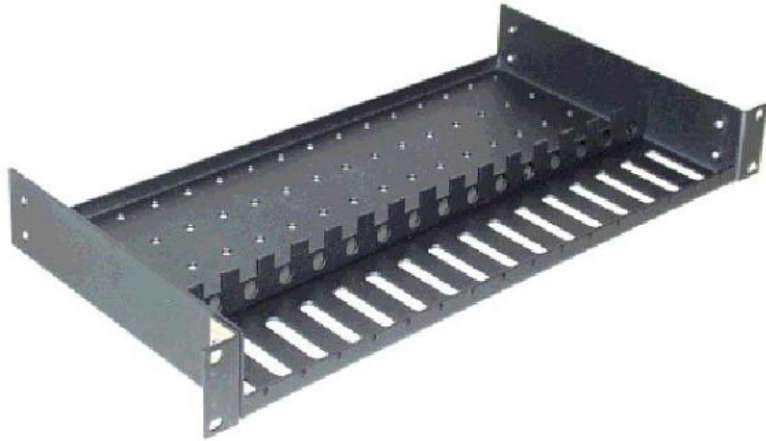


Installation of the Multilink MC-E10 & Multilink MC-E100 Converters is a simple procedure. The installation location is dependent upon the physical layout of the Ethernet network and associated cabling. Make sure the unit is installed in a location that is easily accessible to an AC power outlet or power strip, and where convection cooling is not inhibited. The green Power (PWR) LED must turn ON, when power is applied through the internal DC input 12V, 24V or -48V DC or external AC through 9V DC jack.



#### 4.2 MC14-TRAY for Rack Mounting Multilink MC-E10 & Multilink MC-E100 Series Switches

For 19" rack-mounting of Multilink MC-E10 & MC-E100 series Media Converters, a rack-mount tray is available, MC14-TRAY. The Media Converter units are mounted with their RJ-45 port and DC power jack in the back, with either fiber or BNC cable in the front. Any mix of the FT14-type Media Converters may be placed on a tray, up to a maximum of 16 units. (The mounting spaces of the MC14-TRAY are specific to the "Multilink MC-E10"-series, and do not permit other models).



A typical installation of the model MC14-TRAY, 19" rack-mount tray will hold a few (often three to eight) Multilink MC-E10 & Multilink MC-E100 Converters with their power supplies plugged into power strips (not included) in the rear area of the tray. Metal mounting screws in the bottom-front hold the Media Converters firmly in place. The beveled-top edge of the units permits the LEDs of each unit to be viewed for operational status, even when the units are very close together.

#### 4.3 MC14-TR+PS9 & MC14-TR+PS9X2 for Rack Mounting Media Converters

The MC14-TR+ PS9 and MC14-TR+PS9X2 are another option available for Rack Mounting the mix-match of 10Mbps and 100Mbps Media Converters and the Multilink MC-E10 & Multilink MC-E100 Converters together in 19" rack-mount tray. These models come with built-in common universal AC power supply rated at 55 watts at 50°C ambient, 12VDC output, and supporting up to 10 Switches for MC14-TR+PS9 and 16 units Multilink MC-E10 & Multilink MC-E100 Series for MC14-TR+PS9X2. The MC14-TR+PS9X2 Model has two groups of eight units per power supply. These models are equipped with auto-ranging AC input to the power supplies for use worldwide.

(The MC mounting spaces of the MC14 -TR models are specific to the Multilink MC-E10 & Multilink MC-E100 Series 10Mbps (FT14 and TB14) and 100Mb (14E) series, and do not permit other models to be put in the tray).

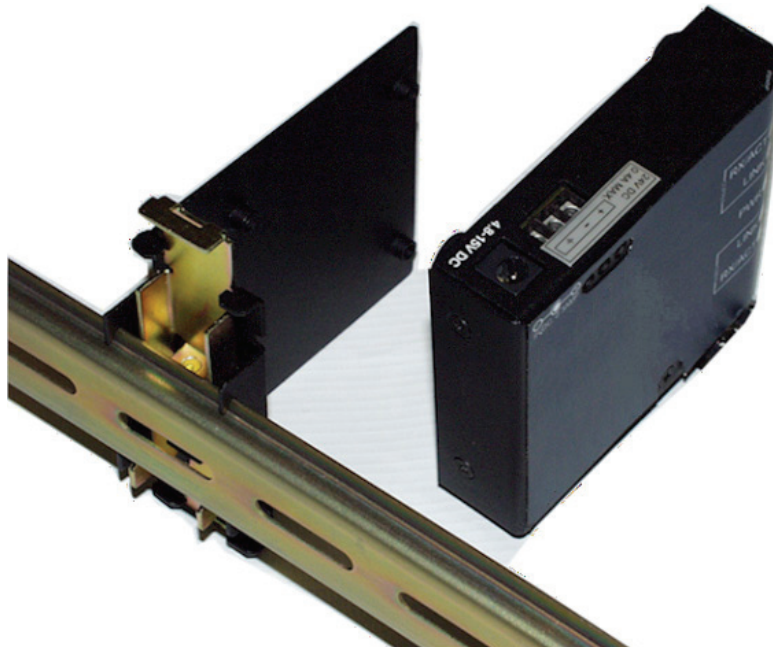


The side-view picture shown here is an example of an installation of the model MC14-TR+PS9, 19" rack-mount tray, holding a few Multilink MC-E10 & Multilink MC-E100 Series , 10Mbps FT14's and 100Mb 14E Media Converters, each with their power input plugged into the built-in common AC power supply in the rear area of the tray. (PS units that come with the MC's are not used.)

Metal mounting screws in the bottom-front hold each of the media converters secure in the tray, separately removable for service. The dual LEDs permit viewing operating status of the Multilink MC-E10 & MC-E100 Converters from any angle.

#### 4.4 DIN-Rail mounting option

The Multilink MC-E10 & Multilink MC-E100 Converters , designed for use in "Factory Floor" Industrial Ethernet environments, are also available for DIN-Rail mounting in an enclosure having DIN Rails.



The metal DIN-Rail mounting hardware is optional and needs to be ordered as a separate item (e.g. Model #DIN-RAIL-MC2). It comes with four screws to attach the bracket to the MC unit. The rail clip is spring-loaded with a pull-up latch at the top for easy “snap-on” attachment and removal.

#### 4.5 Power Requirements for Multilink MC-E10 & Multilink MC-E100 Converters



FIGURE –1: Power Cable - North America



FIGURE –2: Power Cable - International

Multilink MC-E10 & Multilink MC-E100 Converters are power-efficient and can work with an external AC power supply. These Converters require a nominal 12VDC input version.

The 12V DC power input has a plug of 2.5mm, center +ve , with 6 ft. cord. All the AC power supply info detail is provided in *Specifications Section 1.1*.

The Multilink MC-E10 & Multilink MC-E100 Series are designed to provide reliable operation, withstand higher temperature environments, and provide DC power choices for the user to deploy in uncontrolled temperature environments.

The Internal 12V DC (8 – 15V DC) has a built-in terminal block for +, -, ground. The 9V DC jack is also present. Detail information about the 12 VDC, the 24V DC and the -48V DC is provided in the *Specifications Section 1*.

The various models of DC power type and extended ambient temperature power supplies are numerous and your choice needs to be called out on your order.

#### 4.6 Powering the Multilink MC-E10 & MC-E100 with 12V, 24V or -48VDC power input

Each Multilink MC-E10 or E100 is reliably equipped with an internal DC power supply, and has built-in screw terminals for secure attachment of the power leads. Three models support a range of power input types. The three model choices are for use with 12VDC, 24VDC or -48VDC power. DC power input may be chosen for high-availability.



The extended temperature capability of the DC-powered Multilink MC-E10s or E100s can go outdoors, rated at -40°C to +75°C. If indoors, the DC jack is also present and optionally can be used with an external AC power supply.

##### DC Power Terminals:

“+”, “-”, floating

##### Input Voltage:

8 to 15V DC (12V DC)

18 to 26V DC (24V DC)

30 to 60V DC (-48V DC)

##### Input current:

0.8 amp.(12V DC)

0.4 amp max.(24V DC)

0.2 amp max.(-48V DC)

##### Power Consumption:

3 watts typical, 4 watts maximum

#### 4.7 Multilink MC-E10 & MC-E100, DC-powered, -48VDC, 24VDC and 12VDC Installation

This section describes the proper connection of the -48VDC leads (or 24VDC, 12VDC leads) to the DC power terminal block on the MC-E10 & MC-E100 hardened media converter (as shown in Figure ). The DC terminal block on the MC-E10 & MC-E100 is located on the left side of the unit and is equipped with three (3) screw-down lead posts. The power terminals

are identified as positive (+) and negative (-), and they are floating inside the unit so that either of the terminal may be grounded by the user if desired. The chassis is "earth" or ground (GND).



The connection procedure is straightforward. Simply insert the DC leads to the MC-E10 & MC-E100's power terminals, positive (+) and negative (-) screws. The use of Ground (GND) optional; it connects to the MC-E10 & MC-E100 chassis. Ensure that each lead is securely tightened from the top, as shown here.



Always use a voltmeter to measure the voltage of the incoming power supply and figure out the +ve potential lead or -ve potential lead. The more +ve potential lead will connect to the post labeled "+ve" and the rest to the "-ve".

The GND can be hooked up at the last.

When power is applied, the green PWR LED will illuminate.

#### 4.8 Connecting Ethernet Media

Multilink MC-E10 & Multilink MC-E100 Converters can be connected to two media types i.e. fiber and copper (RJ-45) types, run at 100BASE-TX, 10BASE-T and 100BASE-FX, or 10BASE-FL. CAT 5 cables should be used when making 100BASE-TX connections. When the ports are used as 10BASE-T ports, CAT 3 may be used. In either case, the maximum distance for unshielded twisted pair cabling is 100 meters (328 ft). For fiber port 10BASE-FL or 100BASE-FX multi-mode, 50/125 or 62.5/125 microns cabling can be used, whereas for single-mode, 9/125 microns cabling should be used. Fiber cabling supports much longer cable distance and higher bandwidths as compared to copper wiring.

Media	IEEE Standard	Connector
Twisted Pair (CAT 3 or 5)	10BASE-T	RJ-45
Twisted Pair (CAT 5)	100BASE-TX	RJ-45
Fiber (Multi-mode, Single -mode)	10BASE-FL	ST

Media	IEEE Standard	Connector
Fiber (Multi-mode)	100BASE-FX	ST, SC
Fiber (Single-mode)	100BASE-FX	SC, LC
Fiber (Multi-mode)	100BASE-FX	MTRJ



It is recommended that high quality CAT. 5 cables (which work for both 10 Mbps and 100Mbps) be used whenever possible in order to provide flexibility in a mixed-speed network, since P80-series switch ports are auto-sensing for either 10 and 100Mbps. Note that the auto-cross function does not operate, if the port is fixed or not supporting auto-negotiation.

#### 4.8.0.1 Connecting Twisted Pair (RJ-45, CAT 3 or CAT 5, Unshielded or Shielded)

The following procedure describes how to connect a 10BASE-T or 100BASE-TX twisted pair segment to the RJ-45 port. The procedure is the same for both unshielded and shielded twisted pair cables.

1. Using standard twisted pair media, insert either end of the cable with a RJ-45 plug into the RJ-45 connector of the port. Note that, even though the connector is shielded, either unshielded or shielded cables and wiring may be used.
2. Connect the other end of the cable to the corresponding device.
3. Use the LINK LED to ensure proper connectivity by noting that the LED will be illuminated when the unit is powered and proper connection is established. If this does not help, ensure that the cable is connected properly and that the device on the other end is powered and is not defective.
4. For Port # 1 or 1SW, if the LINK LED is not illuminated, move the switch which has a cross-over or up-link for linking to another hub or Switch.

#### 4.8.0.2 Connecting Fiber Optic ST-type, "twist-lock"

The following procedure applies to installations using ST-type fiber connectors. This procedure applies to ports using multi-mode ST fiber connectors.

1. Before connecting the fiber optic cable, remove the protective dust caps from the tips of the fiber connectors. Save these dust caps for future use.
2. Wipe clean the ends of the dual connectors with a soft cloth or lint-free lens tissue dampened in alcohol. Make certain the connectors are clean before connecting.



**One strand of the duplex fiber optic cable is coded using color bands at regular intervals; you must use the color-coded strand on the associated ports at each end of the fiber optic segment.**

3. Connect the Transmit (TX) port (light colored post) on the Fiber port to the Receive (RX) port of the remote device. Begin with the color-coded strand of the cable for this first TX-to-RX connection.
4. Connect the Receive (RX) port (dark colored post) to the Transmit (TX) port of the remote device. Use the non-color coded fiber strand for this.

5. The LINK LED on the front of the fiber connector will illuminate when a proper connection has been established at both ends (and when power is ON in the unit). If LINK is not lit after cable connection, the normal cause is improper cable polarity. Swap the fiber cables at the fiber connector to remedy this situation.

#### 4.8.0.3 Connecting Fiber Optic SC-type, "Snap-In"

The following procedure applies to installations using SC-type fiber connectors, i.e., using multi-mode SC and SC single-mode:

While connecting fiber media to SC connectors, simply snap on the two square male connectors into the SC female jacks of the Fiber connector until it clicks and secures.

#### 4.8.0.4 Connecting Fiber Optic LC-type, "Small Form factor (SFF)"

The following procedure applies to installations using LC-type fiber connectors, i.e., using LC single-mode:

While connecting fiber media to LC connectors, simply snap on the two square male connectors into the LC female jacks of the Fiber connector until it clicks and secures.

#### 4.8.0.5 Connecting Single-Mode Fiber Optic

When using single-mode fiber cable, be sure to use single-mode fiber port connectors. Single-mode fiber cable has a smaller diameter than multi-mode fiber cable (9/125 microns for single-mode, 50/125 or 62.5/125 microns for multi-mode where xx/xx are the diameters of the core and the core plus the cladding respectively). Single-mode fiber allows full bandwidth at longer distances, about 20Km with the multi-mode SC. The same procedures as for multi-mode fiber apply to single-mode fiber connectors.

#### 4.8.0.6 Power Budget Calculations for Multilink MC-E10 & Multilink MC-E100 Series, Fiber Media

Receiver Sensitivity and Transmitter Power are the parameters necessary to compute the power budget. To calculate the power budget of different fiber media installations using GE Multilin products, the following equations should be used:

$$OPB \text{ (Optical Power Budget)} = P_T(\text{min}) - P_R(\text{min})$$

where  $P_T$  = Transmitter Output Power, and  $P_R$  = Receiver Sensitivity

$$\text{Worst case OPB} = OPB - 1\text{dB}(\text{for LED aging}) - 1\text{dB}(\text{for insertion loss})$$

$$\text{Worst case distance} = \{\text{Worst case OPB, in dB}\} / [\text{Cable Loss, in dB/Km}]$$

where the "Cable Loss" for 62.5/125 and 50/125 $\mu\text{m}$  (m.m.) is 2.8 dB/km,  
and the "Cable Loss" for 100/140 (Multi-mode) is 3.3 dB/km,  
and the "Cable Loss" for 9/125 (Single-mode) is 0.5 dB/km

The following data has been collected from component manufacturer's (HP's, and Siemens') web sites and catalogs to provide guidance to network designers and installers



Fiber Port Module	Speed, Std.	Mode	Std. km fdx (hdx)	Wavelength nm	Cable Size $\mu\text{m}$	X'mitr Output $P_T$ , dB	R'cvt Sens. $P_R$ , dB	Worst OPB, dB	Worst* distance Km, fdx	Typical OPB, dB	Typical*distance Km, fdx
Multilink MC-E10-MST, MSC	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125 50/125	-20 -23.5	-31 -31	9.0 5.5	2.5 2.0	14 12	5 4
Multilink MC-E10-SSC	100Mb FX	Single-mode	20 (0.4)	1300	9/125	-15	-31	14	28	17.5	35
Multilink MC-E10-MTRJ	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125 50/125	-20 -23.5	-31 -31	9.0 5.5	3.0 2.0	15.8 12.2	5.5 4.0
Long Reach	100Mb FX	Single-mode	40 (0.4)	1300	9/125	-5	-34	27	54	32.5	65
Multilink MC-E100-MST	10 Mb FL	Multi-mode	2 (2)	850	62.5/125 100/140 50/125	-15.0 -9.5 -19.5	-31 -31 -31	14 19.5 9.5	5 5.9 3.4	17 23.5 13.5	6 7 4.8
Multilink MC-E100-single-mode	10 Mb FL	Single-mode	10 (5)	1300	9/125	-30	-39	7	14	13	26



The use of either multi-mode or single-mode fiber to operate at 100Mbps speed over long distances (i.e., over approx. 400 meters) can be achieved only if the following factors are both applied:

- The 100Mb fiber segment must operate in full-duplex (FDX) mode, and
- The worst-case OPB of the fiber link must be greater than the fiber cable's passive Attenuation.

(Attenuation = Cable loss + LED aging loss + Insertion loss + safety factor)

#### 4.8.0.7 Connections to NICs which support Auto-Negotiation, RJ-45 ports

The copper ports of Multilink MC-E10 & E100 Converters will function properly with NICs (Network Interface Cards) which support Auto-Negotiation, and the Fast Link Pulse (FLP) coding for the 100BASE-TX signaling system. When connecting a NIC to the Multilink MC-E10-Series, it may be necessary to reload the NIC drivers on the user device if the NIC has been communicating with a protocol other than 100BASE-TX (such as 10BASE-T). When 100Mb operation is agreed and in use, the 10/100 LED is illuminated steady ON and is OFF, if 10 Mbps traffic.



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## 5. Operation

### 5.1 Dual-Speed Functionality, and Switching

Multilink MC-E10 & Multilink MC-E100 Converters provide four switched ports (three ports in the front and one on the rear). The architecture supports a dual speed switching environment, with auto-negotiation capability.

The switched RJ-45 ports are full-duplex and auto-sensing for speed. (See section 2.2). When the connected device is 10 Mbps, the Multilink MC-E10s obeys all the rules of 10 Mbps Ethernet configurations. The 10 Mbps users share a 10 Mbps traffic domain, and can "communicate with" 100Mbps users as well as 100Mbps domain. Similarly, the 100Mbps traffic obeys the rules of 100Mbps Ethernet, and can communicate with 10 Mb domain too.

Multilink MC-E10 & Multilink MC-E100 Series units are plug-and-play devices. There is no software configuring to be done at installation or for maintenance. The only hardware configuration settings is user options for port #2, to configure at FF/AN and can be done through a manual switch accessed from the front side. The internal functions of both are described below.

#### Switching, Filtering and Forwarding

Each time a packet arrives on one of the switched ports, the decision is taken to either filter or to forward the packet. Packets whose source and destination addresses on the same port segment will be filtered, constraining them to one port and relieving the rest of the network from processing them. A packet whose destination address is on another port segment will be forwarded to the appropriate port, and will not be sent to the other ports where it is not needed. Packets needed for maintaining the operation of the network (such as occasional multi-cast packets) are forwarded to all ports. The Multilink MC-E10 & Multilink MC-E100 Converters operate in the store-and-forward switching mode, which eliminates bad packets and enables peak performance to be achieved when there is heavy traffic on the network.

#### Switching, Address Learning

The Multilink MC-E10 & Multilink MC-E100 Series units have address table capacity of 2K node addresses, and are suitable for use in large networks. They are self-learning, so that as nodes are added or removed or moved from one segment to another, the Multilink MC-E10 & Multilink MC-E100 Series automatically keeps up with node locations.

An address-aging algorithm causes least-used addresses to fall out in favor of new frequently-used addresses. To reset the address buffer, cycle power down-and-up.

### 5.2 Auto-cross (MDIX), Auto-negotiation and Speed-sensing

All the four RJ-45 ports independently support auto-cross (MDIX) in auto-negotiation mode for speed in 10BASE-T and 100BASE-TX modes. The MDIX does the auto-cross only under the Auto-negotiation mode, and will not take effect if the port is at fixed mode, (port #2 can be fixed to Full duplex). Operation is according to the IEEE 802.3u standard.

When a RJ-45 cable connection is made, and each time a LINK is enabled, auto-negotiation takes place. The Multilink MC-E10 & Multilink MC-E100 Series advertises its capability for 10 or 100 Mbps speed, and the device at the other end of the cable should similarly advertise / respond and both sides will agree to the speed being used. Depending upon the device connected, this will result in agreement to operate at either 10 Mbps or 100Mbps speed.

### 5.3 (F-H) Switch, Full-Duplex or Half-Duplex for Fiber port# 1

The (F-H) manual switch has been provided for fiber port #1, for fixing that port at Full or Half Duplex as per the requirements. The (F-H) manual switch is being located underneath the fiber port. The Fiber port with 10Mb is being set at Half-Duplex, and the 100Mb being set at Full-Duplex as default from the factory. The port can be set at the required mode, by sliding the manual switch position to "F" or "H".

### 5.4 Dual LEDs, Front-panel and side-panel

LED	Description
PWR	Illuminates GREEN to indicate power applied.
LK/ACT	Steady ON for LINK w/no traffic, blinking for activity per port. LINK will turn off in the event connectivity is lost between the ends of the twisted pair segment or a loss of power occurs in the unit or remote device. The Link ports are also represented by LA1, LA2, LA3. (Steady On or steady Off indicates no Receive Activity).
10/100	Steady ON for 100Mb speed, OFF for 10Mb speed per port.
F/H	Steady ON for Full duplex mode, OFF for Half duplex per port.

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## 6. Troubleshooting

All GE Multilin products are designed to provide reliability and consistently high performance in all network environments. The installation of Multilink MC-E10 & Multilink MC-E100 Series 10/100 Mbs Converters is a straightforward procedure. See *Installation - Section 4*.

Should problems develop during installation or operation, this section is intended to help locate, identify and correct these types of problems. Please follow the suggestions listed below prior to contacting your supplier. However, if you are unsure of the procedures described in this section or if the Multilink MC-E10 & Multilink MC-E100 Series 10/100 Mbs Converter is not performing as expected, do not attempt to repair the unit; instead contact your supplier for assistance or contact GE Multilin Customer Support.

### 6.1 Before Calling for Assistance

1. If difficulty is encountered when installing or operating the unit, refer back to the Installation Section of the applicable chapter of this manual. Also check to make sure that the various components of the network are interoperable.
2. Check the cables and connectors to ensure that they have been properly connected and the cables/wires have not been crimped or in some way impaired during installation. (About 90% of network downtime can be attributed to wiring and connector problems.)
3. Make sure that an AC power cord is properly attached to each Multilink MC-E10 & Multilink MC-E100 unit. Be certain that each AC power cord is plugged into a functioning electrical outlet. Use the PWR LEDs to verify each unit is receiving power.
4. If the problem is isolated to a network device other than the Multilink MC-E10 & Multilink MC-E100 Series 10/100 Mbs product, it is recommended that the problem device is replaced with a known good device. Verify whether or not the problem is corrected. If not, go to Step 5 below. If the problem is corrected, the Multilink MC-E10 & Multilink MC-E100 Converter and its associated cables are functioning properly.
5. If the problem continues after completing Step 4 above, contact your supplier of the Multilink MC-E10 & Multilink MC-E100 Series 10/100 Mbs Converter unit or if unknown, contact GE Multilin by fax, phone or email for assistance.

### 6.2 When Calling for Assistance

Please be prepared to provide the following information.

1. A complete description of the problem, including the following points:
  - The nature and duration of the problem
  - Situations when the problem occurs
  - The components involved in the problem
  - Any particular application that, when used, appears to create the problem

2. An accurate list of GE Multilin product model(s) involved, with serial number(s). Include the date(s) that you purchased the products from your supplier
3. It is useful to include other network equipment models and related hardware, including computers, workstations, terminals and printers; plus, the various network media types being used
4. A record of changes that have been made to your network configuration prior to the occurrence of the problem. Any changes to system administration procedures should all be noted in this record.

### 6.3 Return Material Authorization (RMA) Procedure

All returns for repair must be accompanied by a Return Material Authorization (RMA) number. To obtain an RMA number, call GarrettCom Customer Service at (510) 438-9071 during business hours in California or email to **\*\*\*email address\*\*\***. When calling, please have the following information readily available:

- Name and phone number of your contact person.
- Name of your company / institution
- Your shipping address
- Product name
- Serial Number (or Invoice Number)
- Packing List Number (or Sales Order Number)
- Date of installation
- Failure symptoms, including a full description of the problem.

GE Multilin will carefully test and evaluate all returned products, will repair products that are under warranty at no charge, and will return the warranty-repaired units to the sender with shipping charges prepaid (see *Warranty Information, Appendix A*, for complete details). However, if the problem or condition causing the return cannot be duplicated, the unit will be returned as:

#### **No Problem Found.**

GE Multilin reserves the right to charge for the testing of non-defective units under warranty. Testing and repair of product that is not under warranty will result in a customer (user) charge.

### 6.4 Shipping and Packaging Information

Should you need to ship the unit back to GE Multilin, please follow these instructions:

1. Package the unit carefully. It is recommended that you use the original container if available. Units should be wrapped in a "bubble-wrap" plastic sheet or bag for shipping protection. (You may retain all connectors and this Installation Guide.)



Do not pack the unit in Styrofoam "popcorn" type packing material. This material may cause electro-static shock damage to the unit.

2. Clearly mark the Return Material Authorization (RMA) number on the outside of the shipping container.

3. GE Multilin is not responsible for your return shipping charges.
4. Ship the package to:

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## 7. APPENDIX A: Warranty Information

GE Multilin warrants its products to be free from defects in materials and workmanship for a period of three (3) years from the date of shipment by GE Multilin. During this warranty period, GE Multilin will repair or, at its option, replace components in the products that prove to be defective at no charge other than shipping and handling, provided that the product is returned pre-paid to GE Multilin.

This warranty will not be effective if, in the opinion of GE Multilin, GE Multilin has damaged by misuse, misapplication, or as a result of service or modification other than the product. GE Multilin reserves the right to make a charge for handling and inspecting any product returned for warranty repair which turns out not to be faulty.

Please complete the warranty card as this acts as a product registration, and mail it to GE Multilin within two weeks of your purchase.